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**Question Paper Code: 54074**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fourth Semester

Mechanical Engineering

15UME404 - THERMAL ENGINEERING

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The thermal efficiency of theoretical Otto cycle
  - increases with increase in compression ratio
  - increases with increase in isentropic index
  - does not depend upon the pressure ratio
  - all the above
- In air standard diesel cycle, at fixed compression ratio and fixed value of adiabatic index
  - thermal efficiency increases with increase in heat addition cut-off ratio
  - thermal efficiency decreases with increase in heat addition cut-off ratio
  - thermal efficiency remains same with increase in heat addition cut-off ratio
  - none of these
- The specific fuel consumption of a diesel engine as compared to petrol engine is
  - lower
  - higher
  - same for same output
  - none of these
- The knocking tendency in petrol engines will increase when
  - speed is decreased
  - speed is increased
  - fuel-air-ratio is made rich
  - fuel-air-ratio is made lean

5. The ratio of exit pressure to inlet pressure for maximum mass flow rate per unit area of steam through nozzle when steam is initially dry saturated is
  - (a) 0.6
  - (b) 0.578
  - (c) 0.555
  - (d) 0.5457
6. For Parson's reaction steam turbine, degree of reaction is
  - (a) 75%
  - (b) 100%
  - (c) 50%
  - (d) 60%
7. With suction pressure being atmospheric, increase in delivery pressure with fixed clearance volume
  - (a) increase volumetric efficiency
  - (b) decreases volumetric efficiency
  - (c) does not change increase volumetric efficiency
  - (d) first increases and then decrease increase volumetric efficiency
8. In centrifugal air compressor the pressure developed depends on
  - (a) impeller tip velocity
  - (b) inlet-temperature
  - (c) compression index
  - (d) all the above
9. The C.O.P. for a Carnot refrigerator is \_\_\_\_\_ of Carnot heat pump.
  - (a) Same
  - (b) More
  - (c) Less
  - (d) None of these
10. The ratio of mass of water vapour associated with unit mass of water vapour associated with saturated unit mass of dry air is
  - (a) Degree of saturation
  - (b) Relative humidity
  - (c) Specific humidity
  - (d) None of these

PART - B (5 x 2 = 10 Marks)

11. What is the effect cut-off ratio on the efficiency of diesel cycle when the compression ratio is kept constant?
12. List out the effects of detonation.
13. What are the effects of friction on the flow through a steam nozzle?
14. Why clearance is necessary and what is its effect on the performance of reciprocating compressor?
15. What are the properties of good refrigerant?

PART - C (5 x 16 = 80 Marks)

16. (a) Derive an expression for air standard efficiency and mean effective pressure of the Otto cycle. Indicate the various processes involved in Otto cycle through the p-v and T-S diagrams. (16)

Or

- (b) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27°C. The amount of heat added to the air per cycle is 1500 KJ/Kg. i. Determine the pressure and temperature at all points of the air standard Otto cycle. ii. Also calculate the specific work and thermal efficiency of the cycle for the compression ratio of 8:1. Take for air  $C_v = 0.72$  kJ/kgK &  $\gamma = 1.4$ . (16)
17. (a) With neat sketch explain the fuel supply system for (a) petrol engine (b) diesel engine. (16)

Or

- (b) Explain the construction and working principle of any one of ignition system with neat sketch. (16)
18. (a) Briefly discuss the pressure and velocity compounding in turbines with a neat sketch. (16)

Or

- (b) Steam at 10.5 bar and 0.95 bar dryness is expanded through a convergent– divergent nozzle. The pressure of steam leaving the nozzle is 0.85 bar. Find the velocity of steam at throat for max. discharge and steam discharge if the throat area is  $1.2\text{cm}^2$  and the exit area. Assume the flow is isentropic and there are no friction losses. Take  $n = 1.135$ . (16)
19. (a) A single acting two-stage air compressor deals with  $4\text{m}^3/\text{min}$  of air at 1.013 bar  $15^\circ\text{C}$  with a speed of 250 rpm. The delivery pressure is 80 bar. Assuming complete inter cooling. Find the minimum power required by the compressor and the bore and stroke of the compressor. Assume a piston speed of 3 m/s, mechanical efficiency of 75% and volumetric efficiency of 80% per stage. Assume the polytrophic index of compression in both the stages to be  $n = 1.25$  and neglect clearance. (16)

Or

- (b) Explain with neat sketch the construction and working of roots blower and vane type compressor. (16)

20. (a) Explain the construction and working of the vapour absorption refrigeration system with neat sketch. (16)

Or

- (b) Discuss the working of the following with neat diagram:

(i) Winter air-conditioning system (8)

(ii) Summer air-conditioning system (8)

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